

Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 14, 18-22, 40, 43-46, 60, 63, 65, 67-70, 72, and 74-87 are pending in the application, with 14, 40, 63, 70, and 77 being the independent claims. Claims 64, 66, 71, and 73 are sought to be cancelled without prejudice to or disclaimer of the subject matter therein. Claims 1-13, 15-17, 23-39, 41, 42, 47-59, 61, and 62 were previously cancelled. Claims 40 and 43-46 were previously withdrawn from consideration. Claims 14, 20, 21, 63, 65, 67-70, 74-78, 82, and 83 are sought to be amended. Applicants reserve the right to pursue prior claims in a continuation application. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Rejections under 35 U.S.C. § 102

Claims 63, 66, 67, 70, 73, 74, 77, 82, 84, and 86

In paragraph four of the Office Action, the Examiner rejected claims 63, 66, 67, 70, 73, 74, 77, 82, 84, and 86 under 35 U.S.C. §102(b) as allegedly being anticipated by U.S. Patent No. 5,717,252 to Nakashima *et al.* (hereinafter Nakashima). Applicants respectfully traverse these rejections, and request that they be withdrawn.

Nakashima does not teach or suggest all of the features of independent claim 63. Claim 63, as amended, recites the following:

An apparatus for stiffening a ball grid array (BGA) package, comprising:

a stiffener that has a first surface and a second surface, wherein said stiffener has a plurality of openings formed therethrough that are each open at said first surface and said second surfaces of said stiffener, wherein an integrated circuit die is mounted to said first surface of said stiffener;

wherein said second surface of said stiffener is configured to attach to a substrate of the BGA package;

wherein said stiffener has a cavity-shaped portion that is configured to protrude through a window-shaped opening in the substrate, thereby exposing a portion of said second surface of said stiffener when said second surface of said stiffener is attached to the substrate;

wherein the exposed portion of said second surface of said stiffener is configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from the integrated circuit die to the PCB during operation of the integrated circuit die;

wherein a plurality of wire bonds attached to bond pads of the integrated circuit die can be attached to the substrate through said plurality of openings when said second surface of said stiffener is attached to the substrate; and

wherein at least one wire bond couples at least one bond pad on a surface of the integrated circuit die to said first surface of said stiffener.

Nakashima does not teach or suggest the exposed portion of said second surface of said stiffener is configured to be thermally and electrically coupled to a printed circuit board (PCB), as recited in claim 63. Nor does Nakashima teach or suggest at least one wire bond that couples at least one potential pad on a surface of the integrated circuit die to said first surface of said stiffener, as recited in claim 63.

Accordingly, Applicants respectfully submit that independent claim 63 is patentable over Nakashima for at least these reasons. Claims 67 and 82, which depend from independent claim 63, are also patentable over Nakashima for at least these reasons and further in view of their own features. Claim 66 is cancelled. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 63, 66, 67, and 82.

Nakashima does not teach or suggest all of the features of independent claim 70. Claim 70, as amended, recites the following:

A ball grid array (BGA) package, comprising:

a substrate that has a window-shaped opening;

a stiffener that has a first surface and a second surface, wherein said second surface of said stiffener is attached to said substrate, wherein said stiffener has a plurality of openings formed therethrough that are each open at said first surface and said second surface of said stiffener;

an integrated circuit die mounted to said first surface of said stiffener;

wherein said stiffener has a cavity-shaped portion that protrudes through said window-shaped opening, thereby exposing a portion of said second surface of said stiffener;

wherein the exposed portion of said second surface of said stiffener is configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from said integrated circuit die to the PCB during operation of said integrated circuit die;

wherein a plurality of wire bonds attached to bond pads of said integrated circuit die can be attached to said substrate through said plurality of openings; and

wherein at least one wire bond couples at least one bond pad on a surface of said integrated circuit die to said first surface of said stiffener.

Nakashima does not teach or suggest the exposed portion of said second surface of said stiffener is configured to be thermally and electrically coupled to a printed circuit board (PCB), as recited in claim 70. Nor does Nakashima teach or suggest at least one wire bond that couples at least one potential pad on a surface of said integrated circuit die to said first surface of said stiffener, as recited in claim 70.

Accordingly, Applicants respectfully submit that independent claim 70 is patentable over Nakashima for at least these reasons. Claims 74 and 84, which depend from independent claim 70, are also patentable over Nakashima for at least these reasons and further in view of their own features. Claim 73 is cancelled. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 70, 73, 74, and 84.

Nakashima does not teach or suggest all of the features of independent claim 77. Claim 77, as amended, recites the following:

A stiffener for use in a ball grid array (BGA) package, comprising:

a first surface that is configured to mount an integrated circuit die;
a second surface that is configured to attach to a BGA package substrate;

a plurality of openings formed therethrough that are each open at said first surface and said second surface of said stiffener; and

a cavity-shaped portion that is configured to protrude through a window-shaped opening in the BGA package substrate when attached, to expose a portion of said second surface;

wherein said exposed portion of said second surface is configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from said integrated circuit die to the PCB during operation of said integrated circuit die;

wherein a plurality of wire bonds attached to an integrated circuit die can be attached to the BGA package substrate through said plurality of openings; and

wherein at least one wire bond couples at least one bond pad on a surface of the integrated circuit die to said first surface.

Nakashima does not teach or suggest said exposed portion of said second surface of said stiffener is configured to be thermally and electrically coupled to a printed circuit board (PCB), as recited in claim 77. Nor does Nakashima teach or suggest at least one wire bond that couples at least one potential pad on a surface of the integrated circuit die to said first surface of the stiffener, as recited in claim 77.

Accordingly, Applicants respectfully submit that independent claim 77 is patentable over Nakashima for at least these reasons. Claim 86, which depends from independent claim 77, is also patentable over Nakashima for at least these reasons and further in view of its own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 77 and 86.

Rejections under 35 U.S.C. § 103

Claims 68, 69, 75, 76, 83, 85, and 87

In paragraph six of the Office Action, the Examiner rejected claims 68, 69, 75, 76, 83, 85, and 87 under 35 U.S.C. §103(a) as allegedly being unpatentable over Nakashima in view of U.S. Patent No. 6,020,637 to Karnezos (hereinafter Karnezos). Applicants respectfully traverse these rejections, and request that they be withdrawn.

As described above, Nakashima does not teach or suggest all of the features of independent claim 63, and Applicants submit that Karnezos does not supply the missing teachings. At a minimum, any combination of Nakashima and Karnezos does not teach or suggest the exposed portion of a second surface of a stiffener being configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from an integrated circuit die to the PCB during operation of the integrated circuit die, as recited in claim 63. Thus claims 68, 69, and 83, which depend from independent claim 63, are also patentable over Nakashima and Karnezos for at least these reasons, and further in view of their own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 68, 69, and 83.

As described above, Nakashima does not teach or suggest all of the features of independent claim 70, and Applicants submit that Karnezos does not supply the missing teachings. At a minimum, any combination of Nakashima and Karnezos does not teach or suggest the exposed portion of a second surface of a stiffener being configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from an integrated circuit die to the PCB during operation of the integrated circuit die, as recited in claim 70. Thus claims 75, 76, and 85, which depend from independent claim 70, are also patentable over Nakashima and Karnezos for at least these reasons, and further in view of their own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 75, 76, and 85.

As described above, Nakashima does not teach or suggest all of the features of independent claim 77, and Applicants submit that Karnezos does not supply the missing teachings. At a minimum, any combination of Nakashima and Karnezos does not teach or suggest the exposed portion of a second surface of a stiffener being configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from an integrated circuit die to the PCB during operation of the integrated circuit die, as recited in claim 77. Thus claim 87, which depends from independent claim 77, is also patentable over Nakashima and Karnezos for at least these reasons, and further in view of its own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claim 87.

Claims 14, 18-20, 22, 60, 64, 71, and 78-80

In paragraph eight of the Office Action, the Examiner rejected claims 14, 18-20, 22, 60, 64, 71, and 78-80 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Nakashima in view of U.S. Patent No. 5,583,377 to Higgins, III (hereinafter Higgins '377) and U.S. Patent No. 5,291,062 to Higgins, III (hereinafter Higgins '062).

Applicants respectfully traverse these rejections, and request that they be withdrawn.

Nakashima, Higgins '377, and Higgins '062, alone or in combination, do not teach or suggest all of the features of independent claim 14. Claim 14, as amended, recites the following:

A ball grid array (BGA) package, comprising:

a substrate that has a first surface and a second surface;

a stiffener that has a first surface and a second surface, and

wherein said second surface of said stiffener is attached to said first surface of said substrate, wherein said stiffener has a plurality of openings formed therethrough that are each open at said first surface of said stiffener and said second surface of said stiffener;

an integrated circuit die mounted to said first surface of said stiffener;

a plurality of solder balls attached to said second surface of said substrate; and

at least one wire bond that couples at least one bond pad on a surface of said integrated circuit die to said first surface of said stiffener;

wherein said substrate has a window opening that exposes a portion of said second surface of said stiffener;

wherein said exposed portion of said second surface of said stiffener is configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from said integrated circuit die to the PCB during operation of said integrated circuit die; and

wherein a plurality of wire bonds attached to bond pads of said integrated circuit die are attached to said first surface of said substrate through said plurality of openings.

Nakashima, Higgins '377, and Higgins'062 do not teach or suggest the claimed embodiment recited in claim 14. In particular, Nakashima and Higgins '377 cannot be combined to form an exposed portion of the second surface of a stiffener that is configured to be mounted to a PCB to form an electrical and thermal path to the PCB, as recited in claim 14.

For example, Nakashima describes that the “metal substrate 4 is bonded to the TAB substrate with the use of an insulating adhesive 6 composed of a polyimide resin.” (Col. 15, lines 3-5). Thus, Nakashima teaches away from forming an electrical and thermal path to the PCB, as recited in claim 14, and therefore teaches away from combination with Higgins '377.

Nakashima relates to a metal substrate 4 that is different from heat sink 22 described in Higgins '377. Furthermore, metal substrate 4 of Nakashima and heat sink 22 of Higgins '377 are incorporated into different types of semiconductor packages. Higgins '377 uses heat sink 22 to mount a semiconductor die 13 in an opening 20 in an apparently rigid substrate 12. Metal substrate 4 of Nakashima is present to support a flexible TAB substrate.

Furthermore, Nakashima describes “a copper plate produced by forming nickel-plating layers on both surfaces is used as the metal substrate 4.” (Col. 10, lines 46-54). Nickel-plating on copper is typically used in BGA packaging technology to prevent inter-metallic diffusion of other alloys or metals (e.g., solder or gold) into the copper, and molten solder does not wet well on nickel-plated surfaces (i.e., to attach metal substrate 4 to a PCB). Thus, metal substrate 4 of Nakashima is not easily modifiable by Higgins '377 to be mounted to a PCB.

Accordingly, for at least these reasons, Applicants assert that Nakashima and Higgins '377 are not combinable to teach or suggest at least the following feature of claim 14:

wherein said exposed portion of said second surface of said stiffener is configured to be mounted to a printed circuit board (PCB) to form an electrical and thermal path to the PCB, whereby heat is conducted over the thermal path from said integrated circuit die to the PCB during operation of said integrated circuit die.

Accordingly, Applicants respectfully submit that independent claim 14 is patentable over Nakashima for at least these reasons. Thus claims 18-20, 22, 60, and 80, which depend from independent claim 14, are also patentable over Nakashima, Higgins '377, and Higgins '062 for at least these reasons, and further in view of their own features. Claims 64 and 71 are cancelled. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 14, 18-20, 22, 60, 64, 71, and 80.

Applicants assert that claim 77 is patentable over Nakashima, Higgins '377, and Higgins '062 for at least the reasons described above for claim 14. Thus, Applicants

respectfully submit that claims 78 and 79, which depend from claim 77, are patentable over Nakashima, Higgins '377, and Higgins '062 for at least these reasons, and further in view of their own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 78 and 79.

Claims 21 and 81

In paragraph nine of the Office Action, the Examiner rejected claims 21 and 81 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Nakashima, Higgins '377, and Higgins '062 as applied to claims 14 and 20 above, and further in view of Karnezos. Applicants respectfully traverse these rejections, and request that they be withdrawn.

Applicants respectfully submit that claims 21 and 81, which depend from claim 14, are patentable over Nakashima, Higgins '377, Higgins '062 for at least the reasons described above with respect to claim 14, and assert that Karnezos does not supply the missing teachings.

Thus, claims 21 and 81 are also patentable over Nakashima, Higgins '377, Higgins '062, and Karnezos for at least the reasons described above, and further in view of their own features. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 21 and 81.

Other Matters

In paragraph two of the Office Action, the Examiner objected to claims 15-17 because of informalities pertaining to the identification of the claims as "currently amended" instead of "cancelled." Applicants note that in a previous Reply, filed July 29,

2003, Applicants made the appropriate correction. Applicants therefore respectfully request that the objection to claims 15-17 be withdrawn.

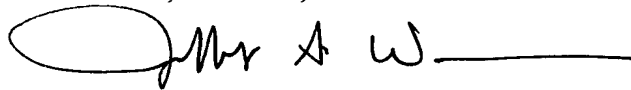
Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

A handwritten signature in black ink, appearing to read "Jeffrey S. Weaver", followed by a horizontal line.

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